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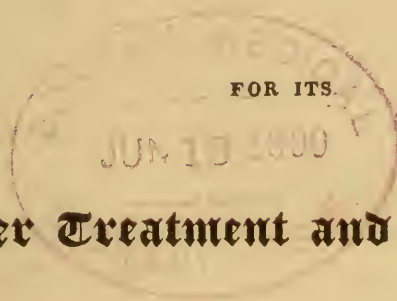
LEADING PHENOMENA

OF

EPIDEMIC CHOLERA,

WITH SOME

PLAIN SUGGESTIONS



Better Treatment and Prevention.

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SINCE the year 1832, when Cholera spread so much alarm throughout Europe, and occasioned so much grievous distress and mourning in Scotland, especially in Dumfries, my native place, my attention has been frequently drawn to the disease, and I have long considered that, as remedies have been provided by the loving mercy and goodness of God, for many of our most serious bodily disturbances, so there may also be somewhere in nature a remedial agent capable of controlling this terrific scourge; and to be discovered if sought after in the full and living faith that God, in the wise course of His gracious Providence, is willing to vouchsafe to us the attainment of some better treatment of Asiatic Cholera than has yet been developed or pursued.

It is with this conviction that I am led to propose what I consider a new view of Cholera, and what appears to me would be an improvement in our endeavours to prevent it, if that be possible, or to treat it more successfully when it may unfortunately appear; trusting that, though my views may be proved

to be in themselves defective, they may be the means, under Providence, of eliciting a new line of inquiry on this painful subject, or of suggesting to some friend of humanity, more skilful and intelligent than myself, a method of rendering the disease somewhat more manageable and less appalling than it is at present.

I am aware that, in bringing forward a view of the kind, I expose myself to the imputation of being bold and venturesome; but, as the Cholera is at this time pursuing nearly its former track, and carrying terror to the hearts of all likely to be in its line of march, without any original suggestion being offered which may afford even a hope of safety to the people, it is not for a man to be timid, or to consult his feelings, at such a season; but a solemn duty for every one, whose thoughts may be inclined to the matter, to suggest whatever may afford a reasonable prospect of arresting the progress, or even of mitigating one feature of the pestilence.

Let every man do his best, regarding this visitation, in a God-fearing spirit, through our Lord and Saviour Jesus Christ; and it will be strange, indeed, and widely different from God's former dealings with his people, if we are not soon favored with some signal mark of the divine compassion.

GUNTOOR, }
15th Sept. 1848. }

To save the reader's time, I have embodied the sum and substance of my views in ten leading paragraphs. I have then gone leisurely into a few general considerations which seem to be required by the novelty of some of my statements; but without giving any particular attention to what has been already written of the disease. Considerable breaks appear in some parts, but these were unavoidable in the necessity I have been under of keeping the matter within the limits of a moderate pamphlet.

PHENOMENA OF EPIDEMIC CHOLERA.

ASIATIC Cholera, being a very peculiar disease, in many respects totally unlike any other with which we are acquainted, may reasonably be supposed to be produced by some peculiar combination of circumstances and to afford some hitherto unnoticed pathological appearances. I feel, therefore, after careful enquiry into its phenomena, justified in putting together the following facts and opinions regarding it.

I. The first alteration in the human body, in the commencement of an attack of Asiatic Cholera, is the formation of a pustular eruption in the mucous membrane of the large intestine, and sometimes also in the first six inches of the small intestine, near the ilio-colic valve. These pustules are exceedingly numerous and minute, though mostly visible to the unaided eye; and, like other purulent deposits, are accompanied at first by acid exudations.

II. The mucous surface of the large intestine is in a positive electrical condition, both before and after the appearance of the acid exudation and pustular punctiform eruption, and during the greater part of the disease.

III. The mucous surface of the stomach, the skin, and perhaps also the bronchial surfaces, are at the same time in

a negative electrical condition and secrete free alkali, simply because the mucous surface of the colon is positive and is secreting acid.

IV. The ganglionic system of the abdomen is, therefore, in a state of high excitement and, from excess of action, resolves the oxygen and hydrogen of the tissues into water, which passes off by the bowel; while the spinal respiratory system is in a state of great depression, and, by its diminished action, permits carbon to accumulate in the blood instead of eliminating it, as in health, from the skin and bronchial surfaces.

V. The positive excitement of the mucous surface of the colon, and the increased morbid excitability of the ganglionic system, is occasioned by the absence of sulphureted hydrogen from the large intestine; while the depressed state of the spinal respiratory system is occasioned by a want, at the moment, of *free* electricity in the atmosphere to excite the respiratory surfaces.

VI. The pustules pass rapidly through the stage of maturation, and their contents escape into the intestine with the acid fluid, formed by the ganglionic decomposing current; and this mixture of pus and acid serum is the peculiar rice-water evacuation of Asiatic Cholera.

VII. The remote occasion of Asiatic Cholera is the continual use of a diet deficient in the sulphur required to assist in forming sulphureted hydrogen to preserve the colon, or part of the body requiring sulphureted animal matter, in its normal electrical condition, and so giving rise to morbid ganglionic excitability. By taking a skeleton map of the world, and brushing with color those parts where the staple articles of diet are deficient in sulphur, omitting only those parts which afford to man abundance of animal and leguminous food, we have in the colored portions a fair view of

the world as it is liable to epidemic Cholera. Or we may arrive at the same knowledge by inspecting a rough tabular view* as follows:

	PARTS OF THE WORLD.	PREVAILING DIET.	Character of diet.
Choleroïd.	Asia, North Africa, South of Ireland, Manufacturing districts of England, Coast places,	Rice. Rice and barley. Potatoe. Coarse bread, potatoe, oatmeal, bacon-fat, fish. Fish.	Not Sulphurous.
Partly Choleroïd.	Continental Europe, North of Ireland, Scotland, All large towns, North America,	Wheat, rye, barley, with a little leguminous and animal food. Oatmeal and potatoe, with a little leguminous and animal food. Do. do. do. Nearly similar diet. Most of the poor population even worse fed. Partly animal partly vegetable.	Only part Sulphurous.
Not Choleroïd.	South America, South Africa, N. S. Wales, South Sea Islands, Polar regions,	Beef. Beef and mutton. Beef and mutton. Pork. Seal and Whale.	Sulphurous.

VIII. All the functional and structural changes of the body, occasioned by Asiatic Cholera, are immediate or secondary effects of the irritation in the colon. That is to say, for example, the peculiar positive excitement of the intestinal surface increases the energy of the ganglionic centres; the ganglionic nervous currents, thus excited, occasion rapid formation and pouring out of fluid, with congestion and arrest of secretion in secreting organs, and serious lesions of the spinal chord, all tending to the continued, steady reduction of pulmonary respiration, and to death, either by Asphyxia or by the gradual exhaustion of nervous excitability.

IX. Though the presence of this excitement in the large

* Only an approximation to accuracy is intended in this table, as I have not any books to refer to at present.

intestine be the immediate cause of the disease, and its arrest by medicine the primary object of all rational treatment; other enlightened modes of treatment must at the same time be directed to the other parts of the body, secondarily affected, according to the stage of the disease.

X. No sanatory precautions of individuals can prevent the occurrence of sporadic cases of Cholera, nor can quarantine regulations of governments hinder it from becoming epidemic, unless sulphur, the inorganic conservative principle which prevents the ganglionic over-excitability, be used as a preventive remedy when the individual or the population is scantily supplied with legumenous or animal food.

A few preliminary observations are now necessary before proceeding to consider the phenomena which I am led to believe constitute the pith of this disease.

The odour of the watery evacuations, in the early stage of Asiatic Cholera, is that of blood. It is most distinct soon after the bowels have fairly cleared themselves of feculent matter, and before the powers of life are much exhausted; but when the vital power is lowered by the continuance of the disease, the odour of blood is masked by the odour of raw meat, and is afterwards replaced entirely by it.

The watery fluid appears also to have most of the chemical characteristics of serum, excepting that of affording albumen.

The flocculi, which render this evacuation so peculiar as to have obtained for it the name of rice-water stool, are small, purulent bodies, mostly extremely like those little rolls of sebaceous matter which are squeezed from the follicles of the skin, and they appear to be excreted from the follicles of the large intestine. They subside slowly in the liquid after evacuation, forming a sediment, and, when washed in distilled water, and agitated with a bulk of *Liquor Potassæ*

equal to their own, they afford a clear, mucous jelly, which appears ropy on being poured from vessel to vessel, and leaves no room in my mind to suppose the flocculi are any thing but purulent excretions.

A train of inductive reasoning, too long for insertion here, leads me to conclude that a parasitic animalcule, somewhat resembling the *Acarus Scabei*, will be found in this purulent excretion when good instruments may be brought to bear on it. If found, I will consider it a result not an essential of the disease, in the same way that the fluke-worm in sheep may be regarded as a consequence, and not a cause of the phthisical affection named Rot.

The premonitory stage of Asiatic cholera is characterized by a very peculiar appearance of the person about to be affected. The countenance is said to wear the expression seen immediately before the accession of the cold stage of Intermittent Fever, but I think it is more like that of a person who has some vague, undefined, central impression of the bowels being about to move. He seems involuntarily to wish to be quiet, though he has no sick feeling and does not complain. The features indicate that the thoughts are turning upon some unknown, indescribable abnormal action or process proceeding within the body, and this expression becomes soon so decided as to convey the appearance of alarm. The phrase may seem an odd one, but I would say he seems as if his electro-magnetic poles were reversed. I have sometimes thought the person had an intuitive sense of some unseen spirit of evil being in the apartment; and, from being myself unaware of what was going wrong, have been surprised soon after by the coming on of Cholera in the individual. This is the period at which I consider the first decided disturbance takes place in the electro-magnetic condition of the person about to be affected with Cholera, and this is the stage at which the disease is clearly most amenable to treatment. In sporadic cases all opportunity of having recourse to remedial measures, at this period, is usually lost, as this peculiar expres-

sion of the person is either unnoticed by his friends or, if observed, is ascribed to anything but the real cause. But at the approach of or during an epidemic, or when Cholera is known to be at hand, there cannot be an excuse for neglecting to attend to this peculiar warning and not discerning its significance. In India I have seen this altered expression very decided two hours before the appearance of other symptoms in a European; and I remember distinctly conversing, in Dumfries in 1832, for a considerable time with a person on whom this expression was very marked, and who was seized about six hours after with the other symptoms usually, but erroneously, supposed by the people to be the commencement of the attack. These I conceive may be considered about the ordinary extent of the premonitory periods in the respective countries; and every one will, I think, agree with me that every endeavour ought to be made to impress upon the minds of the people, when they are expecting an epidemic invasion of this distressing disease, the necessity, I should say the vital importance, of procuring medical assistance the moment the features afford this unmistakable intimation of its approach. When we have this warning sign we can never say with any certainty whether the case will prove to be mild or severe, and this premonitory stage may eventuate directly in the stage of collapse, as it frequently does in the natives of India, thus putting the unfortunate patient almost beyond hope of benefit from any medicine, according to the views generally entertained at present.

The powers of life appear, indeed, often to be almost annihilated immediately after this premonitory stage, and sometimes even before this stage has had time to be fairly developed, and deafness and weakness of voice may be remarked even from the first appearance of perturbation in the countenance. The tubular fibres which connect the bowel with the spinal centre appear to convey the impression of the disease first to the gelatinous, sympathetic,

abdominal ganglia, so that a great shock is given to the entire system before cramps, or purging, or vomiting appear; and so terrible an impression is made on these important centres of life, the sympathetic, that rapid sinking is induced before there is time for the reflex actions of purging, cramps, or vomiting, and the patient dies nearly as hurriedly as if he had, in an unguarded moment, received a severe blow over the stomach, and nearly in the same way.

All matters, usually evacuated from the bowels in other diseases, have more or less the odour of sulphureted hydrogen; but, be the purging severe or slight in Asiatic Cholera, we do not perceive the odour of this gas about the patient. The system seems to be, from the first, devoid of the sulphur to form it. There is abundance of hydrogen, from the decomposition of the solids, passing rapidly off, in combination with their oxygen, in the form of copious, watery exudation from the skin and lower intestines; but there does not appear to be a particle of sulphur either in the gaseous or watery exhalations. As the patient improves, however, and carbonic respiration is gradually re-established, the watery exudations cease, and the intestines begin to excrete hydrogen alone, instead of in combination with oxygen. But sulphureted hydrogen, the healthy secretions of the lower bowel, is not excreted till health is almost completely re-established.

I have already remarked that the odour of the evacuations is like the odour of blood, in the early period of the disease, and afterwards, as the collapse becomes decided, is changed to that of stale meat. These odours from the intestinal evacuations afford, I think, better information of the state of the patient than any other single symptom, and often than any set of symptoms. The voice may be almost gone, the stupidity* great, from the deafness and want of

* Not stupor.

vision, the skin very cold, and the jactitation extreme, and still I would have some good hope of the recovery of the patient, if the serous fluid from the bowels have a distinct odour of serum; while I would consider death to be almost inevitable, and that speedily, if the stale meat odour be once fairly developed. It is, indeed, a symptom of as fatal indications as the other is encouraging; and I consider an earlier intimation of an approaching fatal result may be derived from it than from any other appearance. It shows the nervous system is injured beyond hope of remedy, that the vital control of the sympathetic nerves over the chemical re-action of the fluids is ceasing, and, though the intellect may be still tolerably clear, and the voice intelligible, though feeble, there is merely a living brain on an almost lifeless body, and if a Will be to be made, or the patient be required to afford any information about his affairs, no time should be lost in urging him to do so after the meat odour has been detected. It is a sign the convulsions are about to cease and the jactitations to abate, if they are not already almost ended, and the last catching attempt at respiration by the muscles of the neck is about to follow. But, before this struggle, a clear though short period of comparative calm may be obtained, for the hurried arrangement of any business, such as no other stage of the disease ever affords, not excepting the premonitory, if advantage be taken of the first intimation from the carneous odour.

To obtain an idea of the extent of the excitement in the colon, and of its effects when concentrated on the sympathetic ganglions of the abdomen, we may compare the mucous surface of the large intestine in this disease to a superficies of zinc, of a similar extent, exposed to the chemical action of a weak acid, and the ganglia to points upon which the resulting galvanic action is first concentrated, as in our experiments on decomposition by galvanism. This is the key, as I think may be proved, to all the secrets of the peculiar phenomena of Asiatic Cholera.

Let us look, for a moment, at the working of the disease

I. Most intense and rapid form of Cholera, or *Cholera Asphyxia*.

1. Large intestine diffusely excited throughout.

2. Sympathetic centres intensely excited by concentration of intestinal excitement upon them.

3. Increase of excitement in the sympathetic nerves of the venous groups (lungs, liver, spleen, kidneys) occurring instantaneously with 2, forming, with it, the shock of the disease, and producing aggregation of the blood globules, loss of propulsion in the vessels, consequent arrest of venous circulation, and complete collapse.

4. Excitement induced in the spinal nervous centre, by primary ganglionic excitement, intense, sharp, and transient, ending in complete loss of power in the voluntary and involuntary muscles, so that *a b c* in No. II. do not occur. May be called paralysis.

5. Death from Asphyxia.

II. Ordinary form of Cholera, or *Cholera Spasmodica*.

1. More gradual or more circumscribed excitation.

2. Less intense and more continued excitement of the ganglionic centres.

3. Less decided nervous impression on the sympathetic fibres. Congestion, without aggregation of blood globules. No decided shock.

4. Spinal nervous centre excited by the transmission of the ganglionic excitement, and leading to the continued reflex effects *a* and *b*, alternating with *c*.

a. Explosive purging from remittent expulsion of serum.

b. Vomiting.

c. Excited remittent action or cramp in the voluntary muscles, according to the part of the intestine and corresponding ganglia most excited.

5. Death from continuance of the primary intestinal excitement, and consequent wearing out of the nervous excitability of the whole system.

PRINCIPAL POST-MORTEM APPEARANCES.

1. Skin very little shrunk.

1. Skin much shrunk.

Abdomen.

2. Mucous membrane at lower end of the ilium, and throughout the greater extent of the colon, inclined to dark red, which soon becomes darker on exposure to the air. Nearly the whole of the colon loose and full of serous

2. Mucous membrane of lower part of ilium, and parts of that of the large intestine the same, as to color, as No. I. Colon usually contracted from end to end, and seldom contains any fluid. As the color deepens by

fluid, which may or may not contain flocculi, but seldom does. Is sometimes bulged out at parts and contracted at others. Fluid often issues copiously from the anus when the body is moved.

3. Ganglia deeply injected with blood.

4. Stomach a little contracted; often of usual size or distended with remains of food, and containing alkaline, soapy fluid. Upper part of small intestines generally pale, and containing same fluid as stomach.

5. Jejunum and upper part of the ilium sometimes contain remains of food, but are usually empty.

6. Liver, spleen, and kidneys much congested, especially the liver. Gall bladder full of thick fluid.

7. Large abdominal veins usually full of dark blood, but when the large glands are much congested the venous trunks are often nearly empty.

8. Bladder often very slightly contracted, and may contain urine.

exposure to air, the pus in the follicles becomes distinct like white, pin-head specks, with a fine, black point in the centre. The whole intestine is remarkably free from mucus, and does not exude mucus after death as intestine usually does.

3. Ganglia often packed with blood.

4. Stomach much contracted, so as to resemble a small intestine. It and the duodenum contain a small quantity of alkaline, sometimes turbid, fluid, free from serous odour, but no food. Mucous surface of stomach and duodenum pale and much softened, so that the latter seems to contain soapy chyme.

5. Same as in No. I.

6. Same as in No. I. The fluid in the gall-bladder appears to contain much carbon, and very little sulphur or soda.

7. Same as in No. I.

8. Bladder firmly contracted and almost never contains urine. I suspect the urinary mucous surfaces are very much in the condition of the mucous lining of the stomach, but am not satisfied on this point.

Thorax.

9. Lungs much congested, but sometimes nearly normal. Bronchial membrane often full of serous fluid, but more frequently very free from it.

10. Heart loaded with dark blood in all the cavities.

11. Ganglia of thorax and neck congested.

9. Lungs usually very slightly congested and principally at the back. Crepitate and contract well. Bronchial membrane very like the mucous membrane of the duodenum, and contents of tubes nearly similar.

10. Same as in No. I.

11. Same as in No. I. Pneumogastric nerve highly injected along its trunk.

Cerebro-spinal Axis.

12. Congestion of brain and spinal chord, especially of the latter, and chiefly in its membranes. Effusion of serum into the ventricles.

12. Same as No. I. with more congestion of the spinal veins, which are sometimes ruptured, and more effusion of serum. The spinal chord is as firm as usual but its diameter seems to be diminished.

Oxygen, hydrogen, and nitrogen pass from the intestine in the form of water and very weak nitric acid. At first, when the purging proceeds slowly, the watery evacuation is acid and effervesces with carbonate of potass. Afterwards the evacuation is neutral or slightly alkaline to test paper, owing to undecomposed serum mixing with it, and appears to contain nitrate of potass, as paper dipped in it, and dried, often burns as if prepared with weak solution of saltpetre. Flocculi are not always found in the serous evacuations.

The vomited matters are scanty where no fluid is given, and contain small quantities of flocculent matter like chyme.

Let us now resume our train of reasoning on the nervous impressions.

Death ensues speedily on an attack of cholera, owing to the increased excitability of the ganglionic system, from intestinal excitation, being too much for the spinal system, and so either quickly wearing out the latter or extinguishing it suddenly altogether. If we look over the scale of animated nature we find that where ganglionic life is most fully developed (*e. g.* leech, snail) there is no spinal system. If we look higher and higher in the scale we see the ganglionic system diminish in relative size to the body, as the spinal system attains perfection, till we come to the highest of all, ourselves, and find that in us the spinal centre has an immense preponderance over the ganglionic. It seems then to be a law of nature that, where the bulk of ganglionic excitability is greatest, the presence of a spinal centre would be incompatible with the continuance of life, and we might almost predicate, therefore, that where the spinal centre is in perfection, the ganglionic system must be comparatively small, and its excitability held in comparative abeyance.

To continue the comparison :

Where the ganglionic system is large and the spinal centre comparatively small, as in the frog, we find the respiratory mechanism so contrived that the blood shall circulate only once through the lungs for many times it may be passed through the body. Respiration by the lungs is little needed in such animals, and spinal respiratory impulses are, therefore, not required for the perfect oxygenation of blood and continuance of life. But in man the respiratory mechanism is so constituted that the blood passes more frequently through the lungs than through the body, and a large and perfect spinal respiratory centre is required to enforce the mechanical acts of inspiration and expiration, and insure the free exposure of the blood in the lungs to oxygen. Now, it must be clear that if in man the ganglionic energy should at any time, by over excitation, be made to preponderate over the spinal energy, the latter must be overcome, and he will be at once reduced to the condition of a frog, so far as respiration is concerned, but without the mechanism of the frog's circulating and respiratory apparatus to keep his circulation unembarrassed, and he will therefore first of all have his temperature reduced to that of a cold-blooded animal, and finally life extinguished from an energetic ganglionic centre, and consequent diminished respiratory purification, by the overpowering of spinal respiratory influence being incompatible with the rest of his organization.

Or to take another view of it: A patient, with the ordinary form of Cholera, appears to the eye of my mind to bear a great resemblance to an over-worked electro-magnetic battery, decomposing saline solutions. The large intestine, diffusely excited, represents the zinc, or positive plate, in diluted acid. The skin, bronchial membrane, and stomach, bathed in alkaline fluid, form the negative plate. The ganglionic nerves, involving the extremities of the tubular spinal nerves, are equivalent to the wire coils surrounding the soft

iron bundle, and the induced magnetism of the bundle is the induced vital energy of the spinal centre from the galvanic current in the sympathetics. Here the complete resemblance stops, and here comes out the truth of the comparison. We may highly excite the positive plate of the machine; we may thus increase indefinitely the inducing power of the coils and we will only, so long as our exciting means hold out, make the wire bundle a more powerful electro-magnet. But when the ganglionic system is excited too much, through the intestine, its power preponderates over the spinal system, and soon kills the latter outright by overcoming its chemical cohesion, and by inducing and inducing vital energy in it till it destroys its vitality altogether.

Moreover, ganglionic life seems to have, as one of its offices, the carrying on of what may be called expiration by the union of hydrogen with oxygen, while spinal respiratory life has the opposite peculiarity of conducting respiration by bringing oxygen into contact with carbon; and a cholera patient, being for the time a creature of accelerated ganglionic action and existence, to the partial arrest of spinal respiratory life,* the union of oxygen with hydrogen, at the expense of the solids, proceeds within him to the neglect of the synthesis of oxygen with carbon; so that in cholera the spinal respiratory system is not only overcome through the excitation of the ganglia and oxygen, therefore, not inhaled by the lungs, but by the very same excitation of the ganglia, oxygen is rapidly exhaled from the system by voltaic synthesis with hydrogen, and passed off as water from the bowel or positive pole of the natural voltaic arrangement. Hence the enormous extent of exudation which could never be furnished but by this

* I might adduce another good illustration of this part of the subject from birds, to whom low ganglionic energy, subservient to high respiratory power, is even more necessary than to man.

In connection with this I may merely bring to the reader's recollection the extraordinary deaths among birds, recorded in the daily papers during the epidemic of 1831-2, at least of 1832.

ganglionic expiratory melting down of convertible tissues, and hence the remarkable fall or diminution of temperature which imparts to the skin of man the dermoid functional peculiarities of the Batrachian. Need we wonder then that asphyxia ensues under this double-deoxidizing process.

Now, to apply our principles to practice:

Is this observation of nature, and line of reasoning upon it, likely to yield us even one single clue to the right and scientific treatment of Cholera? I think it is *more than likely* to afford us the information we require; and our reading of the beautiful and instructive page of God's creation would be unusually barren of profitable results to mankind if it did not. The foundation of all rational treatment of Cholera, according to this source of information, must be the arrest of the peculiar excitement in the large intestine, while at the same time we must employ a remedy not only capable of reducing the excitability of the colon, but powerful also in lowering the morbid excitability of the ganglia. Such a remedy we have in sulphureted hydrogen. We know that the life of a frog, for example, is in greater part a ganglionic life, and we know also that one of the simplest modes of destroying the creature is to lower directly its ganglionic excitability. Now there is no agent which acts more promptly and decidedly in lowering or even extinguishing, if we choose, this excitability than the remedy in question, as, when thrown into a frog's intestines the peculiar life of the animal is made to cease immediately; and it is fair to infer that, what directly extinguishes this excitability in that class of animals, will suffice to lower it to the line of health in man, when it is found to be morbidly and destructively active, especially if it be absent, as I have already said it is, when that morbid activity is present; and if it be actually requisite for the continuance and preservation of healthy life in the intestines of the higher animals, as it appears

to be, and as much needed to tone down and keep in subjection the excitability of the ganglia, as oxygen is required in the respiratory tubes to heighten and continue the excitability of the comparatively large spinal respiratory system, which is the peculiar feature in the nervous development of the mammalia.*

In ordinary states of the atmosphere, sporadic cases of *Cholera Asphyxia* occur at 3 A. M. or 3 P. M., as atmospheric electricity is usually latent at that time, ganglionic life therefore high, and spinal respiratory life depressed.

Sporadic cases of *Cholera Spasmodica* originate at 3 A. M., when atmospheric electricity is latent, but the purging, vomiting, and cramps do not usually show themselves till towards 10 A. M., when atmospheric electricity is free, electrical currents abundant, and spinal life most active, as shown in health at that time by increased power of locomotion, respiration, circulation, and expulsive movements.

But when electricity is constantly latent in the atmosphere, from not being set free by condensation of vapour and formation of rain or dew, cholera becomes epidemic, and cases occur at all hours, because the air is then continually, throughout the whole 24 hours of the day, similar to the atmosphere at 3 A. M.

The quantity of watery vapour in the atmosphere is greatest

* A better direct sedative than sulphureted hydrogen may probably be found for this purpose; but I propose it in the mean time in the belief that we ought to replace the agent whose absence seems to have led to the disease. Air, saturated with Chloroform vapour, may prove to be suitable for the purpose, when thrown into the colon, as Chloroform appears to me, when inhaled, to destroy spinal respiratory life by rendering the bronchial surfaces negative. If so it must be a most dangerous anæsthetic agent. Those who have been fairly under its influence vomit, as spinal respiratory excitability begins to return, whether they have or have not taken food, and would, I am convinced, soon have all the symptoms of Asiatic Cholera, were the large intestine disposed at the moment to become electrically positive from the absence of sulphureted alkali.

about 3 A. M., and the air usually calmer than at any other period of the twenty-four hours. The volume of latent ærial electricity is then consequently at its maximum. At or about 3 A. M., the most copious precipitation of moisture occurs in the form of dew, and abundance of electricity is consequently set free by the change from vapour to water, or in other words, when the volume of electricity is large in proportion to the vapour, the vapour is condensed into water, the air is cooled, and electricity set free for other purposes, and one of the most important of these purposes is, the excitation of the spinal respiratory bodies of animals through their bronchial and dermoid surfaces.

During the epidemic in Dumfries, Scotland, in 1832, the air was constantly in this moist, calm, cloudy state, morning noon and night. The sky was so over-clouded that radiation from the earth could not take place at night. No dew was deposited and no electricity set free to rouse and sustain spinal respiratory existence. At last a thunderstorm occurred, electricity flew about, spinal respiratory life was roused, men breathed freely again, and Cholera was gone.

At 3 A. M.,* in all states of the body, the ganglionic electricity or vitality is also most abundant, and spinal respiratory vitality most depressed. The oxygen absorbed during the day, directly from the air by the skin and lungs, and by the stomach and small intestines through the medium of the food and drink, is then incorporated with the tissues. Hydrogen and sulphureted hydrogen then appear in the bowels, and ganglionic excitability is thus kept in check, while the spinal system is being rested and repaired. When the spinal chord is fairly recruited the expulsion of gas commences from the bowels, as the action of the atmospheric electricity, set free by deposition of dew about that hour, stimulates the spinal

* When I say 3 A. M., and 10 A. M., throughout this reasoning, I would have it understood that similar phenomena occur at 3 P. M. and 10 P. M. but in a degree less marked.

bundles through the skin and bronchial surfaces, and the person is thus ready to awake and fit for renewal of muscular exertion.

That is the case in well-fed health, and in the usual, normal state of the atmosphere. But suppose there be no sulphur in the system, or too small a quantity of it, and sulphureted hydrogen do not appear, that is to say, be not secreted; and that no dew be deposited, nor rain precipitated, and, consequently, no electricity set free to excite the bronchial surfaces after or about 3 A. M., then the atmospheric electricity, continuing latent, fosters the ganglionic excitability and permits it to accumulate unchecked, till eventually it becomes intense (large volume in small space), and so overflows, and, by its current, resolves the abdominal tissues into water, and prematurely and morbidly excites induced electricity or electromagnetism in the spinal fibres, or destroys spinal energy altogether.

In health, the formation of secretion from the bowel, by the accumulation of ganglionic excitability, occurs about 3 A. M.; but the movement of the bowels, the result of spinal excitation, does not occur till towards 10 A. M., at which time the spinal nervous power from bronchial excitation is at its maximum.*

* As I am speaking here of some functional peculiarities of the body, about which considerable misunderstanding prevails, it may be well to state, that I have seldom lost an opportunity of making observations which might serve as data for my own reasoning upon the phenomena of disease. When I was House Surgeon to the Dumfries and Galloway Royal Infirmary, in 1838-9, I made many observations of the diurnal variations of the functions of the body, in healthy and unhealthy subjects, during many periods, each of twenty-four hours. One period, over which my observations were made every hour, as the clock struck, extended to three, entire, consecutive days and nights. My attention was directed chiefly to the pulse, skin, and mucous surfaces of the lungs and intestines. The pulse was in every instance compared with the watch. Expectoration, if any, was measured at the end of each hour; and, where the person was liable to spontaneous purgings, a careful Stethoscopic examination of the abdomen was at the same time made, to ascertain, as nearly as possible, at what time the bowels begin to pour out their excretions. The general results were:—

Now the ganglionic over-excitation which leads, in Cholera, to the decomposition of convertible tissues and formation of liquid, commences about 3 A. M., in ordinary states of the atmosphere, but does not lead to exudation and expulsion from the bowel till towards 10 A. M., earlier or later according to the intensity of the ganglionic excitement, when the muscular power, resulting from the energy of the spinal nervous system, is approaching its maximum. But if the ganglionic excitability quickly become too abundant and intense, in proportion to the spinal respiratory, water accumulates in the abdominal cellular tissue, and in the bowel the excitability of the spinal chord is overpowered and neither expulsion of fluid nor cramps take place.*

This will be the time and mode of origin of cases of Cholera, occurring while the air continues to have *decided*, normal, diurnal changes or transitions, in respect to moisture and electricity. But if the vapour be not condensed, and the suspended or latent electricity thus set free, that is to say, if its volume, or state of diffusion in the air, be not changed and electrical currents induced, then the ganglia in the human body will be kept in a high state of excitability, pulmonary respiration will be repressed, and Cholera will occur as an epidemic, all through the twenty-four hours, unless the diet

	3 A. M.	10 A. M.
Pulse,	Lowest rate.	Highest rate.
Respiration,	Lowest rate.	Highest rate.
Expectoration,	Most copious. Bronchii exosmosic.	Least. Bronchii endosmosic.
Skin,	Moist, or wet, exosmosic.	Dry. Endosmosic.
Bowels,	Begin to excude; but secretions not expelled till towards 10 A. M. Sulphureted hydrogen abundant.	Expulsion, but no exudation, and no sulphureted hydrogen.
Atmosphere,	Dew-point high. Electricity latent.	Dew-point low. Electricity free.

* In the afternoon and early in the morning, Natives of India are often found dead, or dying, from Cholera Asphyxia, which has come on during sleep.

or prophylactic regimen be such as to afford sulphureted hydrogen to keep down that excitability.

There is abundance of electricity in the air at such a time, but it is not free electricity, and cannot therefore act as a healthy stimulant to the respiratory surfaces, nor excite the spinal respiratory bodies.

Ganglionic life is at its acme and thrives in very moist air, containing much latent electricity, and spinal life is depressed. Snails appear in abundance in this state of air and enjoy it, for they are invigorated by it; but the frogs never come out till rain or dew has fallen, electricity been set free, and the air fitted for spinal respiratory existence.

To me it appears clear, though I may not have convinced the reader, that Asiatic Cholera is the result of high excitation of the ganglionic system, owing to moist air with latent electricity acting on a human body deficient at the time in the means of forming sulphureted hydrogen; and that the immediate cause of its occurrence is the want of excitability in the spinal respiratory bodies, from there being no free electricity in the atmosphere, at the moment, to excite the respiratory surfaces.

There is a theory of Cholera in extensive circulation at present, bearing the high and justly respected names of Professor Liebig in Germany, and Professor Webb of Calcutta to give us confidence in it.* It is that the blood globules in this disease have lost their property of absorbing oxygen, and the membranes the power of transmitting it to them by endosmosis, owing to the impression of sulphureted hydrogen having been conveyed in some way to the system by miasmata. If this opinion be correct every one would be seized with Cholera after inhaling the air of a necessary during an epidemic. I grant that the blood globules, in Cholera, are altered as they are described to be, and that oxygen is not absorbed; but I consider that the morbid alterations of struc-

* India Register of Medical Science, vol. I. page 100.

ture and function are results, not of the contact of sulphureted hydrogen with the respiratory surfaces, but of a severe irritative impression being made on the ganglionic centres through the extensive mucous surface of the colon, and the consequent cessation of the imbibition of oxygen, and excretion of carbonic acid.

In considering endosmosis and exosmosis as properties of a living tissue, we must not forget that it must be considerably modified by the presence or absence of the peculiar vital force of the sympathetic ramifications—a force which seems to have for its office the government and guidance of the inhalant and exhalant properties of membranes, and the direction of the sanguineous movements in the venous substance of the secreting bodies.

The arrangement and shape of the globules of the blood are altered in Cholera, and these changes are supposed to follow and result from the impression of miasmata also. It may be so; but another explanation of the matter may be offered and one more simple and more in accordance with our present knowledge.

If steel filings were flowing through a metal tube and we were to send a galvanic current through a wire wrapped spirally round the tube, what would be the effect on the filings? If the galvanic current were weak, they would continue to go through with a little change of movement and polarity; but if a strong current were sent through the wire, they would be thrown into all kinds of curious aggregations, and their passage would be stopped till the current should be diminished in intensity or withdrawn. Now, something similar seems to occur in Cholera and may be thus stated, allowing for the differences between a metal tube and a living blood-vessel.*

* I am here supposing that the galvanic current is to the tube and filings what the vital current of the sympathetic fibres is to the blood-vessels and globules of the blood, and not that nervous energy is comparable in every respect to galvanism.

The nervous power of the ganglionic system is put in rapid motion, perhaps increased in intensity for the time, by the positive excitement in the mucous surface of the large intestine, and a shock is transmitted through its ramifications to the plexuses surrounding the blood-vessels, and by this shock the globules are suddenly polarized, as it were, and brought into intimate connection with one another, so that their normal, healthy form is altered or destroyed, their membranous covering burst, perhaps, and there is a complete blocking up of the vessels and arrest of circulation.* The excitement from a stroke of lightning is more intense and rapid, but seems to kill in the same way, by aggregating the blood globules at the same time that it exhausts, or annihilates, the vital power of the nervous system. In this way only can we account for a phenomenon, consequent on Cholera, which has never been, so far as I am aware, satisfactorily explained, and that is the return of warmth and sometimes color to the surface, as well as plumping out of the shrunk skin, which is sometimes, though rarely, noticed a few hours after we are perfectly satisfied that death has actually occurred. It appears to me that polaric aggregation of the blood globules, of which we have been speaking, ceases, in some cases, where their cohesion is weak, soon after the vital force is fairly extinct. The blood is then free to be moved onwards, and is moved onwards, by the elasticity of its vessels reacting upon their gorged contents, and they thus send fluid and its accompanying warmth to the surface of the body. It is a phenomenon which can occur only under these very peculiar circumstances.

* It is very probable that the arrest of circulation may be occasioned partly by the nervous current passing from the extremities of the vessels to their trunks, owing to the galvanic poles of the intestinal tube being reversed, instead of, as in health, from the trunks to the extremities.

GENERAL TREATMENT OF CHOLERA.

WHAT LINE OF TREATMENT OUGHT A MEDICAL MAN TO HAVE RECOURSE TO WHEN CALLED TO A CASE OF ASIATIC CHOLERA? This is a question which has been occasionally asked, for some time past, through the public journals, and is likely soon to be in many mouths, so I shall endeavour to answer it briefly, with reference to my own idea of the disease, by sketching out the main points which ought, I think, to be attended to. I shall, however, first say a few words to the medical practitioner about himself.

When called to a case of Asiatic Cholera, do not approach the patient with a hurried address or manner, as there is no disease more likely to be aggravated by any depression induced by the appearance of anxiety or timidity on the part of those who are about the patient. If you allow yourself to be flurried, you are unfitted for calmly taking all the circumstances of the case into consideration, while you add to the alarm, and lead those about you to imagine that you neither rely on your own knowledge, nor on the knowledge of the day. Faith, here, is every thing—if you wish not to depress the patient's respiratory system. To avoid this nervous state, have the phenomena of the disease and the best modes of meeting each of them fairly in your mind's eye; for nothing, of a worldly nature, can make a man so cool and collected as a full and ready knowledge of what he is

likely to encounter, in the course of his professional practice, and a conviction that he is equal to all emergencies, so far as a mere man may be; except, perhaps, a belief that by his attention to his own regimen, at such a time, he has pretty well secured himself against the appearance of the disease in his own person. Be assured there is nothing to prove Cholera to be contagious, though there is abundance of proof that it is not contagious. You may, certainly, take the disease, if in weak health, and living on spare diet, when you are subjected to the same atmosphere in which the patient became affected, especially if you have been recently much fatigued, or have had your rest interrupted; but not even then, I may almost affirm, if you adopt the prophylactic plan which is here considered necessary to ensure immunity from the disease. Above all, seek for protection and guidance at the throne of Grace, where alone protection and guidance, and strength to act in the right direction, can be found. God alone, who, for His own wise purpose, permits the Pestilence to darken the land, can direct the mind of man to mitigate or avert it; and if our profession will seek to meet the disease, not in their own strength, which is perfect weakness, but in humble and prayerful reliance on the Almighty, they may confidently believe they will be made more than equal to the emergency. I well know how wildly men steer in the troubled sea of an Epidemic, and how inconsistent they are apt to be at such a time, when they forget or have not their trust in God and do not look to Him as the Pole star of their conduct, else I would be the last to offer these remarks; but on an occasion like that of Epidemic Cholera, the members of the medical profession have a great and solemn duty to perform to their fellows, and they must succumb to the general alarm, and be impeded in their intentions and efforts to be of service, unless they offer up such special prayer for support and serenity under the trial, as the onerous nature of their duties and responsibilities, at so impressive a period, must always demand.

To return to the treatment of Cholera :

I. GENERAL DEPLETION.—Asiatic Cholera is not, in its first stages, or when we view it really as Cholera, an inflammatory affection. It is purely a disease originating in extensive, acute irritation of the colon, and irritative excitement of the ganglionic system, and when the patient dies, he dies from a series of organic lesions induced by the most intense form of irritation perhaps ever found in the human body. We have primary, actual, irritative excitement in the large intestine, and secondary, sympathetic excitement in the ganglionic and spinal systems, ending in congestive apoplexy in the latter ; and finally extinction of power from the wearing out of this normal excitability. The first rush or shock of the primary excitement produces, as I have already said, aggregation of the blood globules and congestion in the venous groups of the lungs, liver, spleen, and kidneys, which thereby become unable to move on their contents, while the congestion is further increased by the still existing, though weakened, power of the heart continuing to force blood into them, and these are the phenomena we have chiefly to attend to when considering the propriety of general and local depletions in Cholera.

General blood-letting is contra-indicated from the commencement, except in those cases where there is decided fulness or distention of the heart and large arteries, and when, consequently, there is a probability of important organs being injured by having more inspissated blood driven into them than they can afterwards easily free themselves from. The presence or absence of this state of over-fulness, and the necessity of bleeding or refraining from it, must be determined by the application of the stethoscope over the heart ; and not so much, as it usually is, by the pulse, or the plethoric or aplethoric appearance of the patient.

If the heart be full, feeble, diffuse, and labouring in its action, bleed if it be possible ; as it is then distended, and

is receiving more blood than it can readily pass onwards, weakened as its walls are by the shock to the ganglionic system, and can relieve *itself* only by distending other important organs; but, while you bleed, keep the stethoscope at work so that you may close the vein the moment the sounds of the heart become clearer and better defined, as they will when the quantity of blood circulating through it is better proportioned to the reduced vital force of its parietes.

If we do not, by stethoscope, detect vesicular murmur in the lungs, but only tubular respiration, at the time we examine the heart's action, we may be sure of still more serious congestions in other glandular masses, as the liver and kidneys, which are involved in the mischief at even an earlier period than the lungs.

But before you bleed, even under these circumstances, try the effects of the hemostatic method of relieving the central circulation—that is to say, place tape ligatures at the insertion of the deltoids, and on the upper third of the thighs, and tighten them just sufficiently to compress the superficial veins.* The greater part of the blood, passing into the limbs, will thus be retained in them; they, and not the heart and glandular masses, will be distended; you will have congestion in safe places; and the heart will, in many instances, be sufficiently relieved to render bleeding unnecessary. Only take care while employing this remedy to be guided also by the stethoscope; for a patient may be as much lowered by this method as by bleeding, though without risk of injury, as the removal of one or more of the tape ligatures will quickly permit the return of the blood to central parts.

In this way we may not require to have any recourse to

* Lest this should lead to misconception, on the part of any non-medical reader, I must say, the tape here has nothing to do with the old plan of putting tight ligatures on the limbs to arrest the cramps.

You may as well try to picket a lion with a pack-thread, as endeavour to control the spasms in Cholera by a garter.

general bleeding, so that the patient will be more favorably situated when the great source of irritation is subdued, and there will be less risk of that severe constitutional irritability so often found to continue long after recovery from Cholera, and resulting entirely from the great loss of vital fluid incurred, partly through the treatment, and partly from the disease. Moreover, the less fluid lost the more easily is reaction, when it do occur, kept within safe bounds from the patient being in a better condition for bearing the after-treatment.

II. ARREST OF COLONIC EXCITEMENT AND IRRITATION BY ENEMATA.—This may be either the first or the second consideration demanding attention, according to the particular nature of the case. If the patient appear to be much *depressed* by the irritative action set up, or be in an advanced stage of the disease, you must first try to stop the irritation in the bowel, but if the patient be much *oppressed* by congestion of the heart or brain, or both, and the carotids are *seen* to be unusually full, then we must first use the stethoscope and bleed as it may inform us.

If we bleed first, or adopt the hemestatic method, the Enemata will be more likely to act speedily.

I would recommend the Enema should consist of

Hydro-sulphuret of Ammonia, one ounce,
Water, slightly tepid, one quart,

thrown slowly into the intestine by the stomach syringe, the patient being held on his right side to forward the passage of the fluid to the colcum. This is likely to be of service for a four-fold reason:—First by the sulphureted hydrogen and ammonia rendering the positive excitement of the intestine immediately negative excitement; secondly, by the ammonia neutralizing the acid of the mucous surface, and converting the pus in the follicles into a gelatinous mucous; thirdly, by directly lowering the ganglionic excitement, as I have already said this gas has a powerful influence in accomplishing; and, fourthly, by supporting the general vital power

by the diffusible stimulation of the ammonia, and determining the circulation to the surface.

Lastly. Take care that the cloths be so placed round the Enema tube, and against the anus, that the regurgitation of the Enema be prevented; and retain the cloths to the anus when the tube is withdrawn.

III. EMETICS.—During a period of Epidemic Cholera, digestion and endosmotic assimilation are very imperfectly performed by most people; and for this reason, as well as to rouse the torpid system, it has been the medical custom to enforce the necessity of an emetic being swallowed the moment a person is taken with Cholera. I cannot, however, concur in the propriety of this proceeding.

In very many cases where, from the nature of the epidemic, we may safely predicate the prevalence of spasmodic symptoms, and where, consequently, the run or course of the disease is not likely to be very rapid, the medical practitioner generally sees his patient before spontaneous vomiting has occurred. In such a case I would say, do not give an emetic unless the patient have only recently taken a meal, and appear, besides, to have a tendency to the asphyxiating form. Even then I would try general bleeding, or induce derivative hemostatic congestion in the limbs, before giving an emetic; but if you decide that an emetic must be given, let it be of mustard, or Ipecacuana, as each of these remedies tends to make the stomach positively electrical and induces acid secretion in it, as well as in the skin and bronchial membrane.

I do not consider, however, that this is a safe way of rousing vital power. It rouses it; but in so doing exhausts the little true vital excitability still inherent in the stomach; and that is the very thing we have to avoid—any bit of vitality the patient may still have being too valuable to be tampered with.

Vomiting in this disease has long been considered a whole-

some effort of nature to relieve the patient of some unknown impurities, instead of being seen to be, what it really is, in Cholera, a symptom of *sympathetic* irritation in the nerves of the stomach, occasioned by *actual* irritation in the colon, inducing reflex irritation and reflex muscular contraction, accompanied by alkaline exudation. When vomiting commences you will be but too anxious to allay it from the evidence you will have of its speedily depressing effect; for you may soon be convinced that one act of the straining-vomiting you see in Cholera, will do more in taking the life out of the patient, than a dozen serous evacuations from the bowels, exhausting though these be.

The emetic *may*, in Cholera, rouse the vital power by removing the pulmonary congestion and exciting the respiratory surfaces; but if it fail to make a good rousing impression of the kind (and there are two to one it *will* fail in this effect), and be not promptly and energetically followed up by other and more important aids, you will find, to your sorrow, that you have signally precipitated the disease towards a fatal termination.

The right plan, in my opinion, is, not to give an emetic, unless it be indicated by a meal having been recently taken, but to give cool water, slightly acidulated with nitro-muriatic acid, to render the stomach electrically positive, and to oxidize the tissues, as I have proposed for the assuaging of alkaline acridity and thirst; and, if vomiting ensue, to continue to give this fluid with these intentions, and also to ease the action of the stomach and render the contractile efforts less painful.

IV. ARREST OF SEROUS EXUDATION.—From the view I have already expressed, of the ganglionic origin and galvanic formation of the watery evacuation in Cholera, it may rightly be anticipated that I consider the formation of the fluid cannot be arrested till the ganglionic excitement has been subdued, as already proposed and directed. We might, by powerful astrin-

gents, prevent the exudation of the fluid from the mucous surface of the bowel; but we would, by so doing, convert a case of Cholera into a bad case of Beriberi, and so hasten the fatal event, if the *formation* of water were allowed at the same time to continue unchecked. I say, therefore, do not interrupt the natural relief by exudation but apply a remedy to arrest the cause of the watery formation; and as we gradually overcome that cause, as I have proposed, we may as gradually, and with safety, administer small doses of opium by the intestine, not so much to support the vital power as to strengthen the mucous surface, by its well known effect of stopping exosmosis.

If you give brandy, when there is much serous evacuation, give it with great caution, if the respiratory power be very low; as decided alcoholic stimulation, in the vicinity of the semilunar plexus, is, in this disease, perhaps more than in any other, a forerunner of exhaustion and extinction.

Alcoholic medicine appears to me to be altogether contra-indicated in Asiatic Cholera; the composition of alcohol being one of oxygen, two of carbon, and three of hydrogen. In health, the respiratory system is first called into increased play by it, and the carbon is passed off. Then, when the lungs and skin are exhausted, the ganglionic system is roused to activity and the oxygen and hydrogen, with more oxygen from the convertible tissues or from the food, are carried off. But in Cholera, if alcohol fail to rouse the respiratory system, the carbon must remain in the body to its greater oppression, while the oxygen and hydrogen will only afford so much additional fuel to the already over-excited ganglionic system, and more work for its nervous galvanic battery.

Sprinkle spirit of wine near the patient's head. He will thus have the vapour applied regularly, in small and finely divided quantity, directly to the principal respiratory surfaces, and there will thus be a chance of calling the respiratory nervous system into reflex action. Apply spirit also to the other respiratory surface, the skin, by friction under the bed

clothes; or, better still, what I recommend in the next paragraph. This will tend to the attainment of:

V. RESTORATION OF VITAL HEAT.—This can only be brought about, as I have already attempted to prove, by removing the irritative cause of the depression, and by exciting the carbonic respiratory system.

All kinds of plans for warming the body have been had recourse to, and with no better result, than proving that heating the body by the outward application of caloric will not supply the place of, nor serve as an efficient substitute for animal heat, liberated during the chemical combinations effected through the respiratory portion of the spinal centre; and, moreover, that outward heat, as from hot bricks, bottles, tins, &c., only increases the excitement of the ganglionic system, just as it always does in the instances of people who, from having a weak respiratory system, resort to such aids in bed.*

Keep the skin as dry as possible by the help of warm, soft, cotton sheets, dry, spongy blankets, and plenty of friction

* Tins or bottles of hot water, or heated bricks to the abdomen, indeed heat applied in any way to that region must be extremely injurious in keeping up the ganglionic over-excitement in Cholera. The combustion process attending the formation and evolution of so large a quantity of water as is passed off in Cholera must keep the internal heat of the abdomen above the natural standard, I would say 106°, Fahrenheit, at least. In Cholera, and all diseases which are terminated by rapid purgings, a pungent heat is communicated to the hand placed in the abdomen, when the body is opened, some hours after death. I have remarked the same peculiar heat in the abdomen of a person who died after continued serous draining from the vagina, the result of extensive carcinomatous disease of the uterus and its appendages.

If you required a galvanic battery to work rapidly, whether would you warm or cool it? Warm it, you will say, through its exciting fluid. Well, then, do not heat the ganglionic system in Cholera, for it is too hot already. In fact the internal temperature of the abdomen, during this disease, is as high as the healthy temperature of birds.

with a soft, absorbent towel. Fan the face constantly to excite respiration by reflex action, and for the same purpose dry the face well and sprinkle a few drops of water occasionally on it, drying and sprinkling alternately to induce the patient to inhale. Have the apartment warm and well ventilated. Stimulating the skin with mustard does not do any good; but rubbing the body with spirit of wine is of great service, or, what is better still, a mixture of camphorated spirit with turpentine. This stuff rouses the respiratory system, dries and warms the skin; and, by preventing the escape of the induced electricity of the muscles, arrests the spasms.

Epispastics are not needed, so far as they would be useful in relieving congestions by serous discharge. They only irritate without relieving—often wont irritate or rather cannot irritate, and serous discharge is abundant without their assistance. What you want is, a general rousing application to the respiratory bodies, through the skin, which you have in friction with the above mixture; and last, not least, you must sponge the whole body with weak solution of nitro-muriatic acid to alter the alkaline exudation, which is keeping the skin in its nasty, soapy, sodden state, and to change the whole surface, if possible, from negative to positive-electrical, just as has been said about the stomach.

The sure method of restoring vital heat is, to excite the respiratory muscles by sending an electro-magnetic current from the spinal respiratory bodies to the diaphragm. To accomplish this, have each wire of the machine furnished with a thin, circular, very soft, metal plate; one plate two inches square for the positive wire, the other at least six inches square for the negative wire, and attached to the end of the wire by a small eye, like the eye on the reverse of a button. Bandage the positive plate to the upper part of the nape of the neck, and the negative plate to the upper part of the epigastrium; and then imitate the natural respiratory current by having the battery well charged, and the break of the machine so arranged that the succession of

shocks will occur at the most about twenty five times in a minute.*

VI. RELIEF OF THIRST AND ARREST OF VOMITING.—The agony from thirst and burning in the throat, in Cholera, is well known to be in many cases almost beyond mortal endurance. It is not so, however, from there being a want of fluid in the body, but because there is intense *sympathetic* irritation in the stomach, and exudation of free alkali which will endure more or less in spite of all drinks, so long as *actual* irritation is present in the large intestine. The same may be said of the vomiting. The stomach *will* go through the action of vomiting at intervals, whether you give or withhold fluid; and, as you rather save strength by letting the stomach have something to act upon, so as to prevent straining, it is really a good plan to give water, and to be guided in giving it entirely by the patient's feelings. Let it be cold or any temperature the patient may desire it to be, only do not let it be so cold as to stun the stomach. You may do more, however you may give something likely to be retained. Water, acidulated with nitro-muriatic acid, is an agreeable draught, grateful to the stomach, and may be given as often as the patient will take it; but the best time to administer it is just after vomiting, or an attempt at it, has occurred, for then the stomach will not act again and reject drink till its excitability be renewed by rest.†

* Oxygen has often been recommended as a remedy in Cholera but it is not nearly so much required as stimulation by electric impulsion. There is enough of oxygen in the air at the worst Cholera periods, but there is no free electricity then to cause it to be combined intimately with carbon.

† The burning in the throat, in Cholera, is usually supposed not to occur *till after* the vomiting, and this has always been regarded as a sure mark for distinguishing between this disease and cases of poisoning by Arsenic, in which the burning in the throat comes on before the vomiting. This, however, should never be relied upon in endeavouring to form a correct diagnosis between Cholera and irritant poisoning, as the burning sensation is often very decided before vomiting occurs, in Asiatic Cholera, and is sometimes distressing where vomiting never supervenes.

Do not give Opium to arrest vomiting in Cholera. If you give a small dose, you only incite the stomach to more intense action; while, if you give a full dose to accomplish your purpose, you will at the same time impair the excitability of the respiratory surfaces, and so help to retard or arrest the action of the spinal respiratory bodies. Your whole aim must be to rouse spinal respiratory life; so consider seriously before you give any medicine the principal effect of which is, at all times, and under any circumstances, to obscure, and often to obliterate, its vitality. Besides, in giving Opium either by bowel or stomach, to overcome ganglionic excitability, you increase that excitability before the sedative effect can ensue to that part of the body; while in applying sulphureted hydrogen to the intestine, you apply a *direct* sedative to the ganglia, and one which does not occasion any preliminary excitement.

I believe that opium, applied to any surface of the body, tends to make the electrical condition of that surface negative, if it be not so already; and any medicine of the kind must, therefore, unless the whole foundation of the present view be a gross delusion, be injurious in Asiatic Cholera, however much the outward, visible symptoms may appear to indicate a necessity for its exhibition.

Opium is a poison in Cholera, if there be any truth in the view I advocate, and I must, therefore, protest as decidedly against its employment in this disease as I would enjoin and practice its free exhibition in some other maladies.

The treatment, here, in fact, ought to be in every respect the very opposite of what is indicated in Tetanus. In Cholera, we have to apply a direct sedative to the ganglionic system, through the colon, and to rouse the spinal respiratory by stimulating inhalations and frictions; while in Tetanus we ought to rouse the ganglia by sharp enemata of Elaterium, or some drug of similar action, and soothe the spinal respiratory by sedative applications to the skin and air passages.

VII. INDUCTION OF SECRETION.—It is unreasonable to expect the liver, or any other gland, to afford its secretions during Cholera, so long as the ganglionic excitement is allowed to proceed. The ganglionic nerves are so occupied with the destruction of convertible tissues and their resolution into water, free alkali, and acid, that they cannot afford healthy, nervous energy to the secreting system, and it is, therefore, arrested. It is vain to endeavour to force secretion by giving Calomel. Not only is there none of the peculiar ganglionic energy which prompts secretion, but the glands themselves are so congested, and their blood so inspissated, that they have no serous material to contribute to the formation of their respective products. Neither bile nor urine, the secretions whose absence attracts most attention, can be furnished without serum. Stimulation will neither communicate fluidity to the blood nor put the parenchyma of the glands in motion. Nothing but unembarrassed ganglionic vitality, and the imbibition of fluid, can effect these changes, and ganglionic action cannot be afforded to the glands while it is directed entirely towards the intestinal surfaces, nor can fluids reach these glands till the irritative excitement, commencing in the colon, be arrested. Calomel cannot do good under such a complication of organic and functional derangements. Peristaltic movement of the small intestines is at an end for the time. The duodenum and jejunum remain, throughout the disease, just as they were at its commencement, as is often proved by their contents after death; and the former bowel cannot, therefore, propel Calomel, nor bile neither, even if the stomach could retain that medicine unchanged and pass it on. Calomel, however, cannot continue to be Calomel for any time after it reaches the stomach, in Cholera, as it must be soon converted by the free potass or soda (perhaps both) into the comparatively inert, black oxide of mercury, a pretty good argument, any one would think, for refraining from its exhibition, till the tendency to this peculiar state of stomach have ceased, and Calomel can have a fair opportunity of being really useful by encouraging secretion, when the turmoil of

galvanic decomposition is over. Calomel, indeed, instead of being of any service during the fury of the disease, appears to me to be then extremely injurious, especially if given in any quantity, as we employ it in India; for I think it stands to reason, that any metallic preparation of the kind is apt, at this time, to lower the vital power of the stomach, an effect, of all others, to be avoided in this disease; and that while Calomel has been proved to have an excellent sedative effect on this viscus, when affected with any excitement originating in its own lining membrane, it cannot be supposed to have any such immediate power over the ganglionic system, nor over sympathetic excitement, the result of irritation in the large intestine.

Calomel, to be of service in this disease, must be employed, not during the period of ganglionic excitement, and while the ganglionic energy is being wasted on the destructive distillation of the convertible tissues, but after the ganglionic excitement has been calmed down nearly to the line of health, and when a moderate prompting from a medicine of the class may have some fair chance of recalling the recently rampant, destroying, galvanic current to its legitimate purpose of forming and directing secretion.

It is after, not during Cholera, and to obviate the remote, and not the immediate consequences of the disease, that Calomel ought to be administered; and it ought then to be given in full dose, and with opium, so as to ensure the soothing effect for which, at the commencement of irritative-inflammatory affections, it is, in full dose, justly considered so valuable, and so unique and unsurpassable in its action.

VIII. AFTER TREATMENT.—When the cramps, watery purging, and irritability of stomach have fairly ceased, give one drachm of fine sulphur in any convenient vehicle. This will help to allay thirst, will fairly calm the remaining ganglionic excitement, and put a speedy end to the severe throbbing sensations all over the body, which cause so much distressing uneasiness to many persons as reaction comes on.

Two hours after the Sulphur has been taken, give ten grains of Calomel with two of Opium, unless the latter be contra-indicated, which it will seldom be. Sleep and secretion will thus be promoted together; while there will be no danger of relapse, as the Sulphur will by that time have fairly entered the system and be at work in lowering ganglionic excitement and supporting pulmonary and cuticular respiration, not the least of its good qualities.

Watch the rise of any inflammatory affection, and meet it promptly, by local bleeding or blistering as may be indicated, bearing always in mind that, frequently, more skill is required in treating the after symptoms than in managing the Cholera itself.

One cause of some of the anomalous symptoms, immediately succeeding the truly Choleroid stage, may be the ulcerations which result from the follicular secretion of pus, during the time of the serous purging. Ten days after recovery from Cholera, I have found these ulcerations numerous throughout the mucous surface of the large intestine, especially about the sigmoid flexure. These ought always to be taken into account. Perhaps sulphur, or sulphuret of mercury, with a small bulk of generous diet, would form the best medicine in this case, as I think the ulcers are apt to extend and become foul, owing to the impoverished state of the constitution after Cholera.

Another very important point in the after-treatment is, to give to the patient those substances which will really enable the system to repair itself, and to fit it as much, if that be possible, for the work of reparation as it was previously efficient for its own self-destruction.

Some months after Asiatic Cholera raged in Dumfries in Scotland, in 1832, I received, by the kindness of friends, a considerable number of spinal chords, in alcohol, into which they had been hurriedly thrown, dripping with serum, during the epidemic. The jar contained a thick sediment of phosphate of lime, precipitated by the alcohol, and the chords were covered by it in crystals. This may afford some idea of

the intensity and continuance of the induced electricity in the tubular fibres, as the phosphate of lime could have been set free only by the voltaic decomposition of the nervous matter. The great object must be to carry off or relocate the phosphate of lime, deposited, during the decomposition of the solids, by the galvanic current, in places where it has no proper business, and where it is likely afterwards to impede the healthy performance of functions; and to replace the organic elements, which have also been set free during the disease, but been passed out of the body by the skin and bowels.

The first object may be accomplished by giving phosphoric acid, in small doses, every few hours, to convert the insoluble phosphate, deposited round the nervous centres, into soluble biphosphate, so that it may have a chance of being taken up and again made to occupy its proper position in the tissues, instead of remaining on the membranes of the brain and spinal chord, and so either destroying the patient in a day or two by sudden irritative meningitis, or keeping him for weeks on his back in a semi-paraplegic state, and more dead than alive.

The second intention can be fulfilled only by administering a judiciously-selected diet; but, as I have no intention of making a book at present, I must content myself by merely calling to mind that the main features of our dietetic management at this time must be: 1st. To give a very small bulk of food at one time and to give it frequently, as the vital energy has been seriously impaired, and a single overloading of the stomach may kindle a fatal amount of irritative fever; while from every thing having been thrown out of the body, that could be got rid of, during the height of the disease, there is a great want and craving which must be satisfied as soon and as safely as possible. 2dly. To take care that the food consist chiefly of gelatinous and albuminous substances, and give no rice, bread, arrow-root, gruel, nor any other article containing much carbon; as the system,

owing to the spinal respiratory process being long kept in abeyance during the disease, is now loaded with carbonaceous matters the combustion of which in the lungs and skin will elevate the bodily temperature so much that we will be in all probability glad to resort to vegetable-acid drinks to keep it in check; and, therefore, must be careful not to add fuel to a furnace already too well stored. These may appear small and trifling matters on paper; but the want of some comprehensive, general idea on these subjects has occasioned, I am certain, much loss of life, just when patients have been supposed to be out of all danger.

PREVENTION OF CHOLERA.

A VERY important question is suggested by the consideration of this view of Cholera: Is the pustular eruption in the intestine a peculiar pathognomic feature of the disease: in other words, is it always present with the disease? My idea is that there may be all the excito-irritation on the mucous surface of the bowel, and all the succeeding symptoms leading to a fatal result, and yet no pustules be afterwards found in the mucous membrane, because life has been destroyed before the pustules have had time to appear, in the same way that the skin, and often the entire system, suffers much from Itch before pustules are formed; and that Small-Pox patients sink occasionally before the eruption can be evolved. The most severe irritation from Itch occurs before the pustules appear, and it is fair to infer that the most deadly impression is made upon the vital centres in Cholera before pustular formation can take place in the follicles of the intestine. Besides, in many cases of Asiatic Cholera, even in India, the serous evacuation from the bowel does not contain purulent flocculi, nor flocculi of any kind, and we cannot expect the patients always to survive till the eruption attains the stage of maturation.

This must form a very important consideration in testing the fidelity of my statements, and the correctness of these

views by future inquiries. I myself have had but few opportunities of instituting any really satisfactory practical inquiry on this point. The most marked instance which I have seen of the pustular formation in the follicles of the intestine, was in a case where the patient survived three days from the commencement of the attack, and died, worn out by continued irritation of the nervous system with remittent, serous purging; and in this instance the eruption was well defined and extended from the anus to six inches above the iliac valve. In another case, where the patient fairly recovered from a severe and protracted attack of Cholera, and died, suddenly, ten days after, from pulmonary apoplexy induced by over-dieting, there was, as might have been expected, no eruption, but in its place an extensive sheet of very small ulcerations throughout the colon, chiefly just above the sigmoid flexure.

I believe that in many cases, especially those terminating quickly in death, there will be no pustular appearance; but there will always be in such cases enough of lurid redness in the lining membrane of the large intestine to prove it has been killed by positive excitement, and enough of pulpy softening of the mucous membrane of the stomach to show it has been subjected to sharp alkaline exudation, the result of its negative condition in the disease.

When the eruption is seen it must be considered as peculiar to Cholera, and unconnected with any other state of the system than the Choleroid. I have never seen anything like it in bodies which have died from other diseases, and I have never read of any appearance of the kind.*

* I have repeatedly observed in Cholera patients, who have lived 36 to 48 hours under the disease, a copious eruption of small, white pustules over the skin, on many parts of the body, and have been led to suppose that it may be a kind of pustular metastasis. The patient may be regarded as improving fast when this eruption appears, as the skin is becoming positively excited, but this improvement will be of short duration so long as the ganglionic excitement is allowed to continue.

A membrane must be in a very peculiar state of irritative excitement to furnish any pustular formation of the kind, and it must be, therefore, very clear that, as this condition of the bowel has never yet been recognized, it is more than probable that some very important circumstances connected with the treatment and prevention of Cholera have been omitted by all who have hitherto attended to the subject. Some remedial agent, capable of controlling and preventing the disease has hitherto been overlooked in estimating the exigencies of the system in Cholera, and though the saline treatment in 1831-2 was in some respects a near approach to the true remedy for the complaint, it was yet a signal failure, owing to a want of knowledge of the fundamental features of the disease, and consequent inability to make a well-contrived saline remedy fulfil all the purposes which its proposers expected of its. During that epidemic, scarcely a single individual ultimately recovered from Cholera, who had artificial serum thrown into the system by the operation of transfusion. Almost every one, upon whom the experiment was tried, rallied amazingly under it, and in some cases the patients sat up of themselves, as if they were rising from the dead, immediately after the saline fluid was injected. But the change for the better was always only of extremely short duration, owing to the renewed passing of the serous exudation from the large intestine. The ganglionic, morbid excitement was not destroyed, nor lowered, by the saline solution, which served as fresh fluid to further excite and continue the galvanic decomposing current, and the patient sank often much faster than would have been the case had he been left entirely unaided. It is clear to me that many of these cases, where transfusion was tried, would have recovered had any medical man at that time seen the importance and necessity of lowering the ganglionic excitement before throwing artificial serum into the veins—not that I would countenance transfusion in Cholera, for I look upon it as uncalled for in this disease, seeing that if the irritation in the intestine and excitement of the ganglia

be subdued, the body will soon take up all the fluid it may require by the natural channels of inhibition.

In fact, the want of sulphur in the system appears to be the remote predisposing occasion of the excitement of the mucous membrane of the large intestine, with its pustular eruption, and high excitation of the ganglionic system; while a peculiar electrical condition of the atmosphere appears to be the immediate cause of the disease.

Asiatic Cholera appears to be peculiar to those parts of the world where the food chiefly used is notoriously deficient in matter capable of affording sulphur combinations, or where there is a great waste of those matters in the animal economy from the people being spirit drinkers; and I am induced, therefore, to recommend the employment of sulphur as a remedial agent for the prevention or removal of Cholera, believing it to be the best plan to restore the substance the loss of which seems to lead to the disease.

Sulphur appears to be harmless to the economy of the higher animals, and essential to the freedom of their skin and large intestine from pustular formation. The inefficiency of such dietetic substances, as rice, potatoe, oatmeal, to protect the person from Itch and Cholera thus becomes apparent, and the rapid, epidemic spread of the disease, in countries where such aliments form the staple diet of the people, is easily accounted for. There cannot be a doubt that Itch is the result of a poor quality of food, and rice, oatmeal, and potatoe-eating people are peculiarly subject to it; and I am certain, from all I have yet seen, that wherever Itch is endemic there will Cholera be endemic, and, under certain atmospheric disturbances, epidemic also.

To speak of the prevailing food of India alone. Rice is too much used in this country, both by Natives and Europeans, to the partial or total exclusion of better kinds of diet. The great body of Natives cannot afford to use, or will not take, animal food, but the majority can afford and are permitted to use a pea diet, of which they have several excellent

varieties; and it is the nearest approach to animal food and fully more suitable to Native circumstances, and to the climate. In living mostly upon rice, the Native renders himself liable to disease only in so far as the rice is insufficient for the purposes of nutrition, and does not afford those inorganic, conservative matters necessary to secure the body against the invasion of disease; but when a European, in India, attaches himself much to rice, he does himself an additional injury by giving his decarbonizing organs more work than they can be expected to perform in a hot climate. If a Native eat a large meal of rice, it is speedily exhaled, in the form of carbon, from the lungs, liver, and skin, but chiefly from the dark, decarbonizing skin; but if a European endeavour to subsist on rice he can only get rid of the superabundant carbon by the liver and lungs, as his skin is not a decarbonizing organ, to the full extent it is in the dark races; and the liver and lungs must consequently have too much work thrown upon them. Now the temperature of the air being usually very high in India, the lungs are not stimulated as they are in more temperate regions, and they fail to act decidedly, so as to take a fair share of decarbonizing duty with the liver, and the consequence is, the liver must either do nearly all the decarbonizing business, or the blood must remain loaded with carbon. Hence the remarkable congestive diseases of Europeans in this country, congestions centering very often upon the liver, and hence the asphyxiating tendency of many of our maladies, as sun-stroke, land-wind-stroke, or rather hot-air-stroke, and Cholera. Too little attention, in fact, is given to dieting Europeans in this country with reference to the temperature. Animal and leguminous food is said to be heating, and therefore shunned, while rice, bread, and arrow-root are supposed to have the opposite, or no effect of the kind, and are relied upon for health and strength. The consequence is many of us cram as much carbon as would enable us to keep our bodies comfortably warm in the arctic regions, and, as it cannot be exhaled

by respiration, we feel oppressed, and incur the risk of severe congestion, while we take so little real nutriment that we dare hardly think of a ten-mile walk, feeling we have seldom the strength to go pleasantly through it. A little inquiry would soon enable us to see that we require nutritive much more than calorifiant food in India, and that there would be fewer inflammations, to bring nutritive food into discredit, were there fewer preliminary congestions of important organs, from the blood being loaded with carbon by excess of calorifiant diet. The substance of Cobbett's opinion of the potatoe holds true of rice, and similar dietetic substances. It is a very good food if you have a leg of mutton to it; and the man who desires to have vigorous health, comfortable feelings, and freedom from liability to attacks of Cholera, will always take a good share of the mutton and partake sparingly of the rice, seeing that he requires strength more than warmth in this country. Do not mistake what I say, however, in applying this to our reasoning on Cholera. Rice is not, in itself, deleterious, except in so far as it may burden the respiratory organs and lead to congestion; and it has no power in itself of inducing Cholera in Europeans, as it was once supposed to have, although it undoubtedly often does so, indirectly, by being taken in quantity, to the exclusion of a pea and animal diet, the only food which can impart real healthy strength in this country, and give a man a fair chance of escaping Cholera by keeping in check the excitability of his ganglionic system. When Cholera is likely to become epidemic, soldiers ought to be well supplied with pea soup made with gram, or, better still, minimuloo, in the absence of the dhal or pea of this country, and ought to be encouraged to take it in preference to rice or bread. They would thus have better legs for the road, and less liability to Choleroid disease.

It may be admitted as a great truth, that the poorer the diet of a population, the greater will be the excitability of their ganglionic system, and the greater its preponderance

of activity over the cerebro-spinal, simply because the food does not contain the substances which can alone control the ganglionic excitability, and keep it in that subjection to the respiratory which it ought to be in the higher animals; and it has been established, as a wise provision of nature, that the excitability of the ganglionic system shall increase as the food becomes deficient in the conservative elements, in order that the utmost may be made out of the material at its disposal. This will lead also to great fecundity, as an asulphurous diet is a prolific source of reproduction, and the increased fecundity will ensure a further impoverishment of the diet, from the population becoming too large for the agricultural capabilities or resources of the country, and a greater liability to disease; so that while rice, oatmeal, and potatoe originate a large population by increasing the ganglionic energy and with it the asulphurous, spermatic fluid, it is always a population peculiarly subject, from that very heightening of the ganglionic energy, to great and sudden epidemic mortalities.

Cholera appears to be connected with other diseases, but not as my predecessors on the subject have sought to establish their connection.

The direct tendency of an abnormally-excitabile ganglionic system being to excite too large an amount of induced electricity in the cerebro-spinal axis, the phosphates, essential to the healthy vitality and resistance of that axis to morbid impressions, will be diminished or rather too rapidly dissipated in it, even though they be abundantly supplied by oatmeal—that better kind of poor diet; and there will, therefore, always be, in a population where legumenous and animal food is scarce, or at a price beyond their means, a great liability to fevers, on the slightest exposure to their specific causes, and also a large amount of insanity, epilepsy, and other diseases usually attended with general debility, as it is called, or want of healthy tone of the body.

This view, therefore, appears to me to be useful as an indication, not only of what ought to be our line of proceeding in Cholera, but of how we ought to proceed in the prevention and treatment of other important and often baffling diseases. A large proportion of cases of insanity, for example, are acknowledged to depend upon nervous debility, and are incurable because there is some unknown cause which hinders the debility being done away; but if it could be seen that this debility is occasioned by abnormal excitement of the ganglionic system, inducing the evolution and excretion of the cerebro-spinal phosphates, there would be a reasonable prospect of restoring those often, in the present state of things, hopeless cases by giving either sulphur or a diet containing it, to diminish ganglionic excitability, and replacing the lost cerebro-spinal phosphates by small, daily doses of superphosphate of lime.*

In numerous chronic ailments, also, which render life miserable and often abridge it—uneasy or painful digestion, sense of oppression in abdomen, functional irregularity of the heart's action, with sense of thoracic and abdominal pulsations, leading to suspicion of organic disease—I have found daily doses of sulphur, or a pea diet, from it affording sulphureted hydrogen, extremely valuable in arresting the ganglionic over-excitability in which the morbid sensations have their origin. Many of these cases are accompanied by burning in the throat, with acrid eructations, from free alkali in the stomach, as their most annoying symptom; and this, as pointed out some years ago by Dr. Thompson of Glasgow, is subdued with certainty by diluted sulphuric acid; but I am sure the origin

* Beriberi will at once suggest itself to the professional reader in India, as parallel to Cholera in many important features, pointed out in these views. I am prepared to bring forward a new view of the nature, prevention, and treatment of Beriberi, founded on the principles herein indicated, but am anxious to have the opinions of my medical friends on these principles before proceeding further.

of all these symptoms is ganglionic excitability and can only be removed by a pea diet, or sulphur, assisted by walking exercise to excite the spinal respiratory bodies, and thus equalize the balance of power between the ganglionic and spinal systems.

To return from our digression.

If a man, by living on rice, potatoe, or similar food, to the exclusion of better articles of diet, or by over-exercise, or excitement from spirituous liquors, forces his body to exhale more sulphur salts than his food will daily replace, and so deprives the lower bowel of the quantity of those salts essential to secure its surface against the effects of the abnormal ganglionic excitement, resulting from a poor diet, he will, under certain atmospheric circumstances, be very liable to an attack of Cholera. He may be long in this perilous position and yet not be attacked. But let any circumstance occur, when he is in this state, to lower his respiratory nervous energy for a short time—the omission of a meal, a debauch, exposure to cold, moist air, stagnant air, or hot, moist, stagnant air, for example, and he will be very likely to have Cholera. Now if we put people or nation for individual, and suppose they are in the same position, in respect to a deficiency of sulphureted animal matter, then a marked atmospheric vicissitude, such as I have spoken of in the early part of this paper, may in a moment bring a deluge of Asiatic Cholera among them. By such vicissitude, I do not mean merely such changes as those of which our senses are readily cognizant, but include those also only observable by philosophic instruments, *e. g.* those accompanied by or depending upon magnetic and electric disturbances, of which we have as yet too small a body of observations to be able to adduce much proof from them in considering that difficult question, the origin of disease. While we know enough, however, to be convinced that such disturbances are the immediate causes of epidemics, we also know well that we never can control these pertur-

bations in and around our planet, and that our efforts to guard against disease must be directed to the state of the human body immediately consequent to or accompanying these perturbations, and not to the perturbations themselves.* We thus return to the only point of any practical value in the prevention of Cholera. We cannot prevent or arrest those unfelt, unseen influences which depress the respiratory power, and increase so strangely the activity of the ganglia, but we can, by taking sulphur, or a pea diet, effectually guard the ganglionic system from the insidious excitement

* I have been for sometime anxious to compare the course of the present epidemic, and that of 1831-2, with the directions of the lines of magnetic force on the earth's surface, but have not been able to procure a map of the magnetic meridional lines and curves, and my recollection of a map of the kind, in my possession some years ago, is too vague to allow me to go, with any safety, unassisted into the comparison. There appears to be a decided general similarity in the course of the Cholera and the magnetic lines, and it may turn out that this disease is primarily owing to some disturbance of the earth's magnetic currents. The daily papers lately noticed the almost complete suspension of the phenomena of magnetism at St. Petersburg when the present epidemic reached that city—a statement, if any reliance may be placed in it, slightly corroborative of this idea. We are aware the direction of the compass has varied considerably, steadily, and consistently since correct magnetic observations were first instituted. We also know it is subject to sudden and strange vibrations and to diurnal variation. Can it, then, be also liable to sudden deprivation of power from the absence of free electricity in the air; and, if so, is this magnetic paralysis the result of spontaneous changes in the interior of our own planet, or produced by movements not yet taken into account in other planets, or by some unknown, unappreciated influences of those eccentric orbs, the comets?

The greatest diurnal variation, yet observed, is said to be at 2 P. M., but I am led to believe there must be a still greater daily variation somewhere about 3½ A. M., and that the movements of the needle must be most sluggish immediately before that time, or about 2½ A. M.

I may be wrong, but from what I have observed, I think a long magnetic needle would be a good indicator of the degree of tendency in the air to produce Cholera. When held east and west and allowed to turn to its proper direction, the difference of seconds between the times of its turning in clear, healthy weather, and in latent-electric weather, would give the degree of liability to Cholera, Influenza, White Diarrhœas, &c.

which the peculiar electrical condition of the atmosphere appears to occasion.*

All who have died of Cholera, in my recollection, and whose habits were known to me, were either long accustomed to a diet from which little sulphureted matter could be obtained, or, if living generously, were at the same time using wine or spirits to an extent that would insure the passing off, by the exhalants, of almost all the sulphur and other saline bodies afforded by their good diet.

There are, according to my experience, among Europeans, two classes of persons peculiarly liable to Cholera—the temperate, whose diet consists too much of vegetable substances, deficient in sulphur, and who are characterized by thin, pale, rather sallow skins—and the intemperate, having the same appearance of skin, from their inability to take a sufficiency of good, wholesome food after long continued irregular courses, or an unhealthy excess of floridity in their complexions from their still retaining appetite to enable them, amidst their excesses, to eat abundantly of animal food.

I believe that further inquiry, specially directed to this subject, will prove, in time, that Asiatic Cholera does not affect individuals who daily eat a fair proportion of animal or leguminous food, provided they do not compel their exhalants to excess of expulsory action by injudicious exercise or the use of spirits; and that recently or actually volcanic countries, as Iceland, Italy, and South America, and those parts of other countries where sulphurous waters are abundant, enjoy a comparatively great immunity from it. And

* Much has been written about flannel belts as preventives of bowel complaints. In time of Cholera they are invaluable. Their utility consists in their exciting and sustaining the respiratory action of the skin; and we ought, therefore, to carry out the principle of their action by our practice and wear flannel over the greater part of the skin when we are in the vicinity of Cholera. Cuticular respiration would thus be well kept up, and the bronchial surfaces would participate in the benefit by healthy, reflex excitement.

I would, therefore, recommend as most important advice to those who are expecting the approach of Cholera, or have it among them, to make their diet consist very much of animal and legumenous matter, especially the latter; or if they have not the power so to improve their diet, or are prevented, for medical reasons, from partaking of such articles, I would urge upon them the propriety and necessity of taking every day, or every other day at furthest, a small amount of sulphur in some form or another. I think that in time of Cholera the addition of twenty grains of sulphur daily to the system would, after it has been taken for one day at least, insure a perfect immunity from the disease. I cannot, at this moment, call to mind any state or condition of the body which would forbid the use of sulphur at this rate, though I could name many conditions of apparently healthy individuals which would be much benefited by it. This quantity would at once affect the surface of the bowel; but would do little to affect the system, if the person have been for any length of time on a poor diet, for when sulphur is given daily to patients living almost entirely on rice several days always elapse before the body is saturated with it and begins to exhale it.

Much loss might be saved to the Indian service were regiments put under some similar hygienic system; and much fear and anxiety would be withdrawn from individuals by attention to it, in a country where the alarm from Cholera is often sufficient to unnerve the bravest. Every one is aware, in this country, that when a regiment moves, Cholera is almost sure to break out in it, and every one who has marched with a column of men during a close, still night in India, knows that under such circumstances sulphur, in all its animal combinations, is exhaled most abundantly. It need not be wondered, therefore, that Cholera does show itself at such times, as no attempt has yet been made to replace the sulphur so evaporated except by leaving the men to recover it from their diet, which, as most people of ordinary military and chemical information are aware, cannot in general afford it.

I hope yet to see the day when sulphur in small quantities will be regularly issued to every soldier in the field in India, say forty grains per day, while actually marching, and twenty grains per day during halts, as a sure way of warding off this terrible disease; and I have a firm belief that sulphur, so employed, will be as effectual in banishing Cholera from our armies, as lime-juice has been in eradicating scurvy from our fleets.*

From the track which the epidemic is at present pursuing, it is not probable I shall be able of myself, for an indefinite period, if ever, to determine practically the correctness or incorrectness of the views I have adopted as to the prevention of Cholera; but all my reasoning on the subject convinces me more and more of the great importance of sulphur as a prophylactic; and, although I do not expect any man will take sulphur with this view in time of Cholera unless he have the same reasonable conviction of its importance as a conservative agent in the animal economy, I can only say, in all sincerity, that I would not, with God's blessing, fear an epidemic, if I were sure of a constant supply of sulphur or a diet containing it.

The more I consider the rapidly successive pathological alterations which occur in Cholera, and the fatal bearing of even the least of them on the continuance of life, the more impressed I am with the belief that no plan of treatment will ever much diminish the mortality among those cases where the disease has been permitted to make a decided impression on the system. Even the plan of treatment I have proposed is not likely much to increase the proportion of

* Speaking of fleets: fish diet is the worst of all for predisposing the person to Cholera, and a pea diet the best for protecting the body from it, according to the views I advocate. The inhabitants of places well supplied with fish have ever suffered most from Cholera. Sailors actually on board ship, and eating pea-pudding and pea-soup, have almost always escaped, though ships must have often been in the track of the Epidemic.

recoveries, unless it be had recourse to at an early period of the disease, and before any delicate or important organ has been injured by congestion, and I would, therefore, be all the more earnest in urging upon those who have reason to dread Cholera the adoption of some such course of prophylactic regimen.* No sailor delays the use of lime-juice on a voyage till scurvy show itself in his ship, so, in my humble opinion, soldiers on a march should not be permitted, at the present time, to put off the taking of sulphur till Cholera appear in their camp. If prevention be better than remedy, in respect of all diseases, it may be truly said it is safer to rely on preventive measures than trust to remedial means in the special instance under consideration—never to speak of the inward satisfaction and freedom from dread, which is always afforded to the individual when abiding in a prudent, health-preserving course of conduct, but which, even of itself, is of no mean value in buoying up the powers of life against the invasion of disease.

Freedom from dread of the disease is, indeed, a state of mind of much more direct importance in time of Cholera than has yet been supposed, even with all the allowance that has been made for the immediate effect of alarm at that time on the nervous system. Not only is fear directly injurious by diminishing the appetite and, therefore, the supply of nutritive and saline substances to the body, but it is actually of itself a state of nervous depression which permits a more than usual exhalation of sulphur combinations. We all know the potent and rapid effect of terror on children in disordering, as it is popularly called, their intestinal secretions, which are often, soon after a fright, extremely offensive from being loaded with sulphureted matter; and, what follows in this way any sudden, depressing impression on the

* In many cases of Cholera, recovery is a physical impossibility, owing to some vital organ or organs being unable, from former disease, to withstand the effects of any severe congestion in whatever manner it may be induced.

susceptible nervous system of the child, occurs also to the adult when he is the unfortunate victim of that abject, animal terror experienced more or less by every one during an epidemic of Cholera, even by those who, having their thoughts fixed on heavenly things, are enabled to hold the world at its exact value, as well as by those who have been long indifferent to their soul's concerns.

Anxiety, fear, and dread all induce nervous depression with increase of exudation from the skin, kidneys, and intestines. Minor degrees of fear act upon the bowels by increasing their gaseous exhalations, producing what may be called gaseous Diarrhoea, while more marked impressions, on more susceptible minds, are followed by liquid purging. This leads to further depression and increased dread in time of Cholera, and these again to more loss of saline matter, so that what was at first merely a fear of the disease soon becomes, during epidemics, a real case of what was apprehended. The very cry of CHOLERA is sufficient to produce bowel complaint, and the consequent expulsion of the already too small quantity of sulphur, usually present in the body, under a course of poor living; and the person thus easily falls a prey to an attack of Cholera. So potent, indeed, is fear, in thus depriving the body of sulphur, that I might almost, with propriety, affirm that the mere report of the occurrence of a single case may, by alarming and depressing the public mind, give rise to an epidemic, or at least aid materially in originating and spreading the disease as an epidemic. Hence the great importance, at such a time, of suggesting some prophylactic regimen, which may be approved of by ordinary reason, and at the same time affording to the people every encouragement to adopt it, and rely upon it, by submitting to them the plain rationale of its operation. Many a sad scene might thus be prevented in European regiments in India; for when Cholera breaks out in a European corps, many of its members seem to take to spirit-drinking for no other reason than to escape all thought of their perilous

position; and, as has been well expressed by a writer on Suicidal Insanity, "are so afraid to look Death in the face that they rush into his arms." The comparatively abstemious habits and superior peripatetic philosophy of the native soldier save him from much of this alarm and its consequences; but there would be little of it any where, on the appearance of this disease, if the men were put upon a preventive medicine in which they could be led to rely; and were aware, at the same time, that if they did take Cholera they would still have as fair a prospect of getting safely over it as they have in many other diseases. At least Cholera and death would no longer be to them synonymous.

As the secretions of the stomach are always slightly acid in a state of health, alkalescent food ought to be as much as possible avoided during the prevalence of Cholera; and, if any precaution be thought necessary in addition to the taking of sulphur, an occasional small dose of any of the mineral acids may be recommended to those who have occasionally acidity in the throat, as being not only supporters of the positive healthy condition of the stomach but, at the same time, excellent tonics. People in England are far too fond of taking soda as a remedy for heartburn, forgetting, or not knowing, that the morbid sensation in the throat is, unless in overly well-fed persons, more frequently the result of alkalinity than acidity in the stomach. Among the poorer classes this alkalinity is very often the consequence of eating greens, of all food the most pernicious in time of Cholera, as it at once places the stomach in the very electrical condition it is required to be in to constitute a leading feature in Cholera. Very many cases of Asiatic Cholera, sporadic and epidemic, have had boiled greens for the proximate cause of their occurrence, and I cannot imagine any thing so likely at once to set up the choleroïd state in a person predisposed for the disease by an asulphurous diet.

Any excess in liquids ought to be avoided, when Cholera

is prevalent, and the people ought to be cautioned to avoid, at such a time, the use of ardent spirits, if they are not in sufficiently good circumstances to afford to eat a fair proportion of leguminous or animal food daily; or if, from sickness, they should be hindered taking it, then I say let them abandon ardent spirits altogether. Their use is attended with risk of injury at all times, and under any circumstances, while health can be perfectly well preserved without them; but, when Cholera is about, it is indicative of great ignorance or want of judgment, to say the least of it, to have recourse to spirits as part of the diet or even to use spirits as a medicine, unless an urgent necessity for their employment is clearly indicated to a medical attendant, and proper means be adopted at the same time, such as giving small doses of some preparation of sulphur, to keep in check the ganglionic excitation induced by alcohol. I am well aware that many men have escaped Cholera while indulging freely in drinking spirits at a Cholera period, and numerous instances of the kind have passed under my own observation, but these have generally been men who were seldom, even for a short interval, free from alcoholic excitement.*

The more I look into the matter, the more I am convinced that the most perilous position for a man to be in, during the approach or prevalence of Cholera, next to being unable to procure a sufficiency of good leguminous or animal food, or to obtain sulphur as a medicine, is to have his system continually drained of saline substances, and his ganglionic nerves excited by the daily imbibition of ardent spirits.

Nearly as much may be urged against the use of Wine

* The risk of Cholera to the drunkard is, not while he is under the influence of spirits but, when the effects have passed off and left him devoid of the saline matters, exhaled during the excess of stimulation, and bereft of nervous energy.

and Beer under similar circumstances; but with this difference in the argument, that, while spirits are directly injurious to the body, in predisposing it to Asiatic Cholera by exciting the ganglionic system, and forcing the exhalation of sulphureted matters, essential to the enjoyment of vigorous health, wine and beer are specially hurtful so far as they are taken to the exclusion of the solid food necessary to sustain the system, and, therefore, ought to be left off, if a good amount of wholesome, solid food cannot be taken with them. They are too much respected as articles of diet and taken in quantity; instead of which they ought to be regarded merely as condiments, and used with great moderation, if used at all. Man is not so constituted as to be in safe health, that is to say, to enjoy a fair immunity from disease, upon any such liquid diet; and, though we must allow wine and beer are of great service to the constitution in certain states of health, and at an advanced age, we must ever bear in mind that they are of very inferior importance as life-sustaining and strength-giving agents; indeed, of scarcely any importance, compared with sound, solid food. If a man desire to have the elements of a man in him, and to be armed at all bodily points so as to have a reasonable hope of resisting the onset of disease, he must take such solid food as will afford *all* his bodily elements, and exclude from his system every article which will either indispose him for taking solids, or may induce his exhalents to expel the saline principles which these solids afford.

Moist air, either hot or cold, is also extremely prejudicial in predisposing to Cholera, as it is not only a good conductor of electricity, and so tends to lower the nervous power of resisting disease, so far as that power depends on electricity in the system, but is also a great encourager of gaseous exhalation from the body (exosmotic), and by robbing it of its sulphur, in the form of sulphureted hydrogen, conduces materially to bring about an asulphurous

condition of the tissues, and morbid ganglionic excitability. We all know how much more decided the sulphureted exhalations from decaying organic matters are in a moist air than in a comparatively dry atmosphere, and those who associate much with masses of working men are aware that the same state of the air promotes, and renders very evident, similar exhalations from the human body. We must be careful, therefore, while we attend to taking animal or legumenous food, in order to escape Cholera, that we do not, by living in a damp and sulphur-absorbing atmosphere, encourage the vaporization from our skins of a greater proportion of sulphur than we daily swallow. The spread of Cholera is favored not so much by the effluvia from drains and cesspools, though these are hurtful enough, by depressing spinal respiratory energy, as by the moistness of the air they engender, leading to the protecting sulphurets being withdrawn from our bodies to the increase of ganglionic excitability; and, though a good diet may support our nervous power, even under these depressing circumstances, the sulphurets will evaporate from our bodies and we must be liable to Cholera when electricity is latent in the air, if we dwell in damp localities, unless we thoroughly drain and dry them. This seems to me to be an important and hitherto neglected reason for the inhabitants of low and damp situations, as vallies, river-banks and cellars, being the principal sufferers from Epidemic Cholera, and appears to account for the fact that Cholera has been very fatal in many places which appeared to be clean and wholesome, but where the dew point *must* have been high, and has at the same time passed harmlessly over adjacent places which abounded in every thing supposed to be capable of insuring its attack, but where the usual air of the place must have been comparatively dry. I can in this way explain many of the vagaries of Epidemic Cholera in attacking some towns and neglecting others, directly in its path, or in depopulating one quarter of a town while in another

quarter of the same town few or no cases occurred; and, if a pamphlet would permit me to extend my illustrations sufficiently, I could prove, pretty clearly, that Asiatic Cholera is not so inconsistent in attacking or avoiding places as it has been supposed to be.

Damp air, then, though not a principal, being yet an important accessory cause in inducing and promoting Cholera, let every attention be given to keep the air of towns, expecting its approach, as dry as possible by deep-covered drains, and by opening the lines of building, if that may be done, in every part where a free circulation of air cannot be otherwise obtained.

For the same reason, I would say, do not form an encampment on the bank of a river, if the bank be near the level of the water, or if the prevailing current of air be likely to direct the river-vapour directly towards the camp. Much surprise has sometimes been expressed at the apparently strange circumstance of part of a regiment on one bank of a stream being visited by Cholera, the other on the opposite bank all the while remaining free from sickness, though probably not much more than a stone-throw distance; but I think that in this way of accounting for it there can be little mystery in the matter.

One more caution and I have done with this part of the subject. When medicine, likely to produce sweating or purging, is given to a person having any ordinary disease in time of Cholera, such medicine ought to be combined with sulphur, lest Cholera be induced by the diaphoretic or purgative. Many ordinary diseases run into Cholera, during a Cholera period, and I suspect it is so sometimes from the medical attendant unwittingly depriving the patient of the little sulphur present in him. A medical practitioner ought, therefore, to be careful that his patients do not become poorer in sulphur salts through his mismanagement. When the epidemic of 1832 was impending over some places in Great

Britain, many medical men advised the people to preserve an open state of their bowels as an important precautionary means of warding off Cholera; and many, to my certain knowledge, who unfortunately followed this usually good advice, found, to their unavailing sorrow, that the solvency from the laxative medicine gradually merged into the Choleroid evacuation. One medical error after this fashion is quite enough in a century, and it is to be hoped it will be carefully avoided should another necessity of the kind ever unfortunately occur for special instruction in personal hygiene. If laxatives must be given when Cholera is in the horizon, combine them with sulphur; or, better still, let the sulphur itself be the laxative.

Cholera, I conceive, can be avoided only by having particular regard to the carrying out of the plain, broad principles of hygiene, based on the fact that sulphur, either in the diet, or in the form of prophylactic doses by itself, is essentially necessary to arm the human body effectually against it. It is not by attending to draining, ventilation, cleanliness, &c., alone that we can hope to escape from Cholera, for people in marching regiments take Cholera on ground which is dry and airy, but by insisting on these things being done with especial reference to damp and stagnant air having a connection with the coming of the disease by inducing an asulphurous state of the system, as well as depressing the pulmonary respiration, and by inducing the people as much as may be, and as their circumstances will afford it, to use the diet adapted to the threatening of the period. Much of the money, spent upon medicine for the poor in English dispensaries, would be much more advantageously employed, when there is a dread of Cholera, in providing good pea-soup for the needy multitude, and would often be fully more to the purpose in checking premonitory Diarrhœas than all our expensive astringent tinctures. If we always had the diet suitable to our bodily circumstances, there would be much less need of medicine; so every endeavour should be made, at such a time, by those who have the conduct of charitable

institutions, to afford to the poor the kind of diet best adapted for arming their constitutions against the disease most likely soon to assail them. In this way much good would accrue to the public, and much waste would be prevented, for food is little better than wasted if it be not suitable *in every respect* to the immediate exigencies of the persons partaking of it.

With reference to the military body, I may say, that the faster men are marched, with a view to escape from Cholera, the more sulphureted animal matter will be taken out of them, and the more liable they will be to the disease. During marching, perhaps more than in any other exercise, the spinal respiratory system is brought into severe action, and its excitability is pretty well expended by the time the body can be permitted to rest. During a march, ganglionic excitability is in comparative abeyance, but it afterwards preponderates over the respiratory, and is apt to acquire a morbid ascendancy when the body seeks repose. The right way of meeting the emergency of Cholera on a march appears, therefore, to be either at once to give sulphur, or to halt at a place where the dew point is low (say 20° below the ordinary temperature, if such a place can be attained), till the men can regain sulphureted matter from a good legumenous or animal diet—the former having the preference; and to make them put on flannel next the skin when their exercise is over.

Marching about 2 A. M., appears to me also to be of some advantage, as, by so doing, spinal respiratory excitability is called into increased operation to counterbalance the ganglionic activity which is about that time tending to a morbid excess.

I have now, in conclusion, to say a few words about the deficiency of practical proof of the correctness of the views I have here endeavoured to set forth; as it may be urged that I have been premature in bringing these views before the public.

My reply, to any such objection, is, that the publication of a new view of the nature, treatment, and prevention of a malady of the kind, must of necessity precede any thing like satisfactory, practical inquiry into the merits or demerits of the view. I have pointed out the most probable immediate cause of the disease, the precise locality of the body in which the disease appears to commence, the only possible reason, so far as I can perceive, in the present state of our knowledge, for the human body being liable to it, and afforded a fair and reasonable hope that, by the employment of a safe and simple prophylactic agent, the disease may be prevented or arrested; and in so doing have done as much, I humbly think, as an individual with very limited opportunities can be fairly expected to accomplish. The value or worthlessness of all this must be put to the test by public bodies, or others having the weight of authority on their side, before any judgment on the view can be reasonably pronounced. Besides, how can any medical or hygienic plan of the kind be put to the proof, in the only way it can be fairly proved, unless by laying the plan before the public and endeavouring to show that, while there is nothing in it contrary to reason, and which may not be acted up to with all safety, there is much in it affording a good prospect of a favorable result. The colors must be shown before people can be enlisted in the cause. It would be unreasonable to expect a commanding officer, or head of a medical department, to give permission for every one of a body of men in the public service being periodically dosed

with sulphur, or put upon a pea diet, when Cholera is among them, if he have never had his attention solicited to the subject, and be unaware of the good likely to ensue upon sanctioning the measure; but I would fain hope that, even after this brief notice, a matter apparently so important may not be allowed to drop; but may meet with the attention it appears in my humble opinion to deserve, not so much from any trouble I have taken in bringing it forward, but through its own intrinsic merits; and that those who are in authority, especially my superiors in the department in which I have the honor to serve, may be induced to issue such instructions, and afford such aid, as they may consider requisite to further inquiry into a subject so momentous to the welfare and interests of mankind.

No country affords so many constantly recurring opportunities as India for studying this disease, and of testing the value of any plan for its treatment and prevention; and, as India bears the unhappy odium among the nations of having emanated the malady, it will be well if it be also permitted, through the merciful providence of God, to disarm the scourge by originating the use of a satisfactory remedy.

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